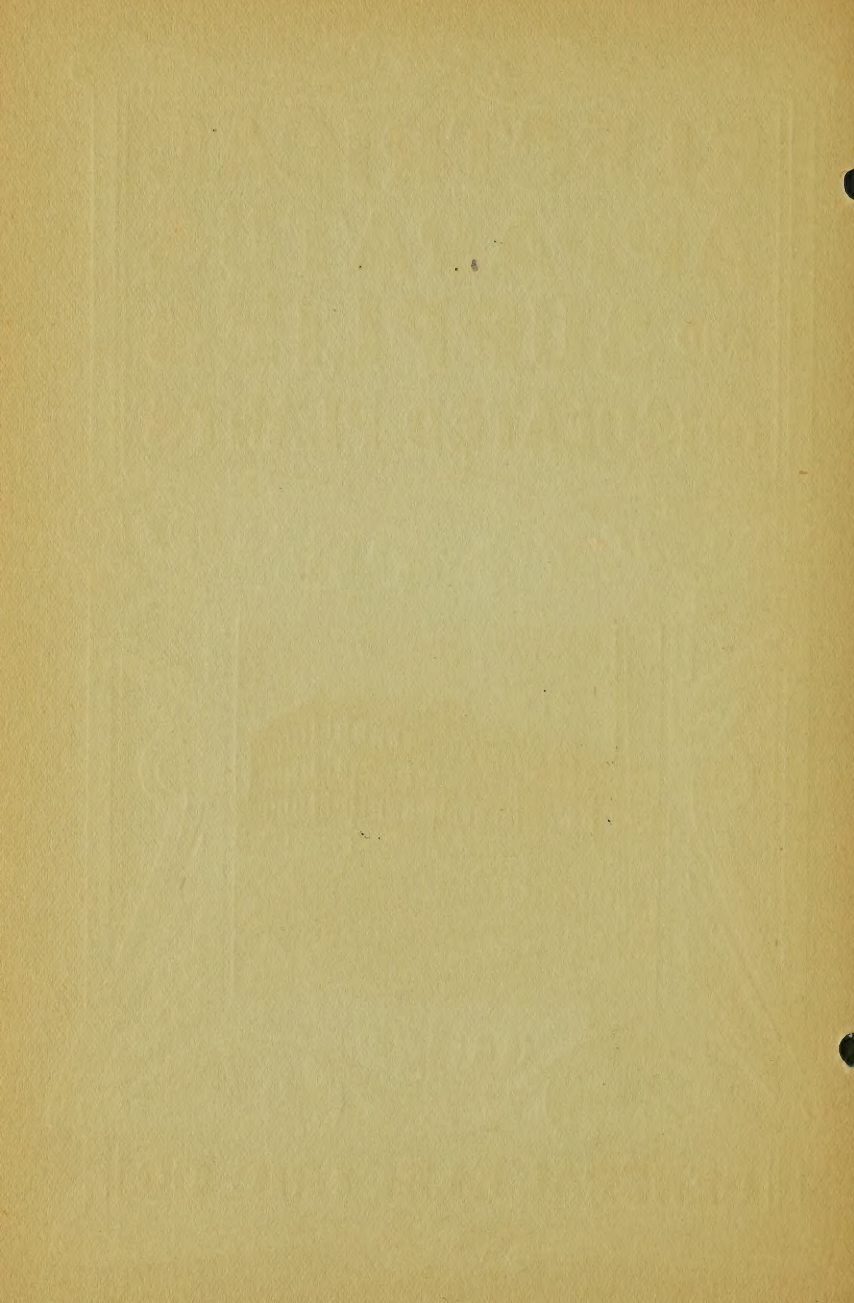


**ELECTRICAL
APPARATUS
AND SUPPLIES
FOR ISOLATED PLANTS**



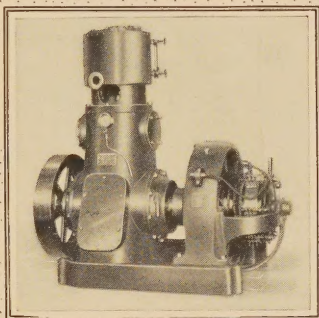
GENERAL ELECTRIC CO.







ELECTRICAL APPARATUS And SUPPLIES



JUNE 2ND 1902 - 1042

FOR ISOLATED PLANTS

GENERAL ELECTRIC COMPANY.

Everybody
should use Elec-
tric Light, obtain-
ing the supply
from the nearest
Central Station.
If impossible to
secure such ser-
vice, install a
General Electric
Company's Small
Plant.

INTRODUCTION



THE General Electric Company occupies an unique position in the electrical business in that it can furnish from its own shops, every electrical device necessary for the complete installation of an electric lighting and power plant.

Prospective purchasers will find it desirable to place their orders with one concern, as by so doing responsibility is not divided, and a complete, uniform, standard outfit will be obtained.

The demand for apparatus for isolated lighting has increased continually since the introduction of the incandescent lamp, and electric light is now universally conceded to be the only form of artificial light suitable for the illuminating of factories, creameries, mills, machine shops, breweries, country residences, country clubs, sugar plants, plantations, cotton compresses, etc. Every such institution should use electric light for artificial illumination, not only on account of the satisfactory quality of the light which is, of course, unrivaled, but because of the remarkable convenience with which it may be installed and operated. Beside

GENERAL ELECTRIC COMPANY

these advantages, there are the low cost of operation and maintenance, and the decreased insurance rates obtained where electric lighting supersedes other types of illumination. If it is impossible to secure service from a nearby central station, it is wise to install a complete electric plant on the premises.

In the pages following is given a general description of the various devices manufactured by the General Electric Company, which are necessary for a complete installation. If information in detail is desired on any of these devices, the Company will be very glad to mail it upon application to the nearest sales office.

All material recommended by the General Electric Company has been approved by the Fire Underwriters.



GENERAL ELECTRIC COMPANY

CONTINUOUS CURRENT APPARATUS

THIS class of electrical machinery is most commonly used for small plants. It is particularly suitable for such purposes and is the only apparatus which can be used for charging storage batteries.



GE VERTICAL SINGLE CYLINDER OPEN TYPE ENGINES AND MULTIPOLAR GENERATORS WITH IRONCLAD ARMATURES

CLASSIFICATION			Volts Full Load	Amperes Full Load	Floor Space	Height	Weight Pounds	Diameter Steam Pipe	Diameter Exhaust Pipe	Diameter Cylinder	Stroke
Type	Poles	Kw.									
MP 4-2½-700	4	2½-700	110	23	39" x 23"	32½"	900	1"	1"	3½"	3"
MP 4-4-600	4	4-600	110	36	52" x 27"	41"	1600	1"	1½"	4½"	4"
MP 6-7-550	6	7-550	110	64	50" x 30"	46"	2500	1½"	1½"	5"	4½"
MP 6-10-450	6	10-450	110	91	57" x 34"	51"	3200	1½"	2"	6½"	5"
MP 6-15-400	6	15-400	110	136	62" x 37"	60"	4500	2"	2½"	8"	6"
MP 6-20-360	6	20-360	125	160	75" x 48"	68½"	5700	2½"	3"	9"	7"
MP 6-30-305	6	30-305	125	240	80" x 48"	76"	7700	3"	3½"	11"	8"

Ratings of sets with single-engines based on 80 lbs. steam, non-condensing.

GENERAL ELECTRIC COMPANY

DIRECT COUPLED ENGINE- GENERATOR SETS

THE General Electric Company has for many years supplied all the engines and generators for the United States Navy. These engines are so

uniformly satisfactory that a demand has arisen for similar sets for commercial

work, particularly in isolated plants.

The requirements of such sets are compactness, light weight, simplicity, freedom from vibration and noise at high speed, perfect regulation, durability, and finally

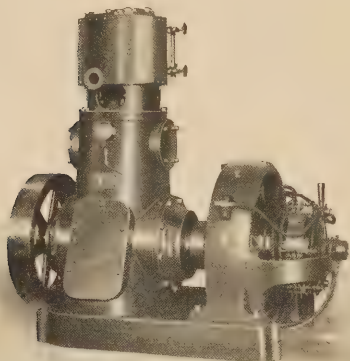
low cost. Those who equip their plants with these engine-generator sets will be able to buy from the General Electric Company everything required for the installation excepting only the boiler equipments. The generators are mounted directly on the engine bed-plate and their design and construction are particularly compact.



DIRECT COUPLED GENERATING SET
MP 6-30-305 WITH SINGLE
CYLINDER ENGINE

GENERAL ELECTRIC COMPANY

ENCLOSED TYPE ENGINES



AN ENCLOSED TYPE ENGINE COUPLED TO
AN MP 6-15-400 GENERATOR

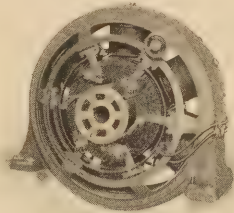
A LINE of vertical single cylinder engines of the enclosed type direct coupled to generators is also manufactured. This type of engine has met with marked success. All the moving parts are enclosed by the engine casing, allowing perfect lubrication and reducing wear and attention to a minimum. The bearings are provided with an automatic forced lubrication system, which insures quiet running under all conditions of load.

GENERAL ELECTRIC COMPANY

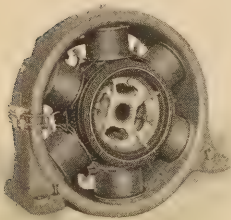
DIRECT DRIVEN GENERATORS FOR LIGHTING AND POWER

CONTINUOUS CURRENT

THESE generators are designed for direct connection to engines, the armature being arranged for mounting upon the engine shaft. For many installations these machines have important advantages which are lacking in belt driven machines. In some cases they are the only machines suitable for isolated plants on account of their quiet operation; the



A 35 KW. CONTINUOUS CURRENT GENERATOR FOR DIRECT DRIVING



THE ENGINE SIDE OF AN MP
6-35-300 GENERATOR

noise and vibration which accompany the use of belt driven machinery being entirely lacking. They are economical in floor space, and operate at a higher efficiency than belt driven machines. These machines are built for both 125 and 250 volts.

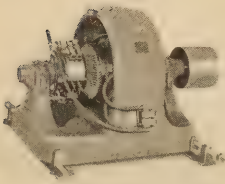
DIRECT DRIVEN FORM L GENERATORS WITH IRONCLAD ARMATURES, CARBON BRUSHES AND OUTBOARD BEARINGS, 125 OR 250 VOLTS

CLASSIFICATION	MINIMUM SPEED WITH SPECIAL YOKE		OUTPUT AT BRUSHES		Approx. Brake H. P. to Drive	Arm. and Com'tor	APPROX. WEIGHT, LBS. Generator Complete
	125 Volts	250 Volts	Amperes	Volts			
Type							
Poles							
Kw.							
Speed							
MP 6-25-305	265	275	200	125	37	850	3,500
MP 6-35-300	260	270	280	125	52	1,250	4,600
MP 6-50-280	235	245	400	125	75	1,500	6,250
MP 6-75-270	225	235	600	125	112	2,550	8,800
MP 6-100-270	225	235	800	125	150	2,950	11,200

GENERAL ELECTRIC COMPANY

BELT DRIVEN GENERATORS SLOW AND MODERATE SPEED

WHENEVER it is desirable to install belt driven generators, General Electric Form H multipolar machines are recommended. As the result



A MODERATE SPEED
GENERATOR
MP 4-30-1050 FORM H

of this Company's years of experience with this class of apparatus, these generators have reached, both electrically and mechanically, their highest development. Their efficiency and uniformly satisfactory operation are well known. All parts are

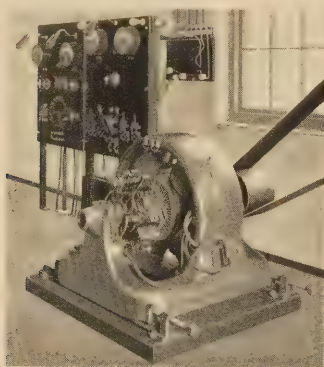
designed with a view to securing the very best possible operation, and the construction is such as to permit easy accessibility. Reliability of operation and facility of repair in case of accident are of prime consideration to the owners of isolated plants. These are established characteristics of the Form H machines. The method of armature construction is such that failure of insulation is practically impossible; in fact, the insulation used in these generators is practically indestructible, except by heavy overload. An important feature of peculiar value

SLOW SPEED GENERATORS, FORM H

CLASSIFICATION						WEIGHT, LBS.	
Type	Poles	Kw.	Speed	Volts Full Load	Ampere Full Load	With Rails	Without Rails
MP	4	6.5	950	125-250-500	52-26-13	1030	970
MP	4	9	900	125-250-500	72-36-18	1435	1350
MP	4	13.5	850	125-250-500	108-54-27	1900	1810
MP	4	17	750	125-250-500	136-68-34	2665	2565
MP	4	20	700	125-250-500	160-80-40	3350	3200
MP	4	30	675	125-250-500	240-120-60	4935	4780
MP	4	40	605	125-250-500	320-160-80	5690	5520
MP	4	50	600	125-250-500	400-200-100	7140	6930
MP	4	75	550	125-250-500	600-300-150	8800	8560

GENERAL ELECTRIC COMPANY

to plants of this character is the perfect working of the commutator and brushes under all conditions of load. Changes from no load to full load, or even moderate overload, can be made on all of these generators without necessitating the shifting of the brushes. A minimum of attention is required, owing to the fact



A SMALL PLANT

that carbon brushes are used and the bearings are of the self-oiling type. When desirable, the Form H generators can be specially adapted for direct driving from engines of suitable speed, by mounting the generator on an extension of the engine bed-plate, and connecting the armature to the engine shaft by means of a coupling.

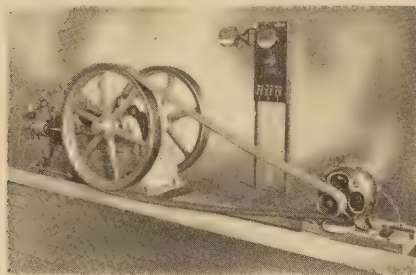
MODERATE SPEED GENERATORS, FORM H

Type	CLASSIFICATION					WEIGHT, LBS.	
	Poles	Kw.	Speed	Volts Full Load	Ampères Full Load	With Rails	Without Rails
MP	4	9	1450	125-250-500	72-36-18	1030	970
MP	4	12.5	1350	125-250-500	100-50-25	1435	1350
MP	4	17.5	1175	125-250-500	140-70-35	1900	1810
MP	4	25	1100	125-250-500	200-100-50	2665	2565
MP	4	30	1050	125-250-500	240-120-60	3350	3200
MP	4	45	975	125-250-500	360-180-90	4935	4780
MP	4	55	925	125-250-500	440-220-110	5890	5520
MP	4	65	875	125-250-500	520-260-130	7140	6930
MP	4	85	750	125-250-500	680-340-170	8800	8560

GENERAL ELECTRIC COMPANY

SMALL BELT DRIVEN GENERATORS

SLOW AND MODERATE SPEED



A SMALL PLANT
CE GENERATOR DRIVEN BY OIL ENGINE

FOR generators of a smaller capacity than the four-pole machines listed on the previous pages, the General Electric Company supplies generators of the CE Type. They occupy small floor space and their compact design, with the protection of all parts given by the peculiar construction of the frame, makes them specially desirable for small installations. The standard machines are intended for belt driving, but they can be readily adapted for direct driving by means of a coupling.

GENERAL ELECTRIC COMPANY

TYPE CE GENERATORS

SLOW SPEED

Type	Poles	Kw.	Speed	Volts Full Load	Amperes Full Load	Shipping Weight, Lbs.
CE	2	1.5	1250	125-250	12-6	610
CE	4	2.25	1250	125-250	18-9	780
CE	4	3.75	1250	125-250	30-15	921
CE	4	5.5	1050	125-250	44-22	1300
CE	4	7.5	850	125-250	60-30	1825

MODERATE SPEED

CE	2	2.25	2100	125-250	18-9	610
CE	4	3.75	2100	125-250	30-15	780
CE	4	5.5	1875	125-250	44-22	921
CE	4	7.5	1625	125-250	60-30	1300
CE	4	11	1300	125-250	88-44	1825

GENERAL ELECTRIC COMPANY

ALTERNATING CURRENT APPARATUS



ALTERNATING CURRENT GENERATORS IN
THE POWER HOUSE OF THE GREAT
NORTHERN PAPER COMPANY,
MADISON, ME.

THIS type of apparatus is especially recommended for large installations the current of which is to be used for driving a great many electric motors as well as for lighting by arc and incandescent lamps.

GENERAL ELECTRIC COMPANY

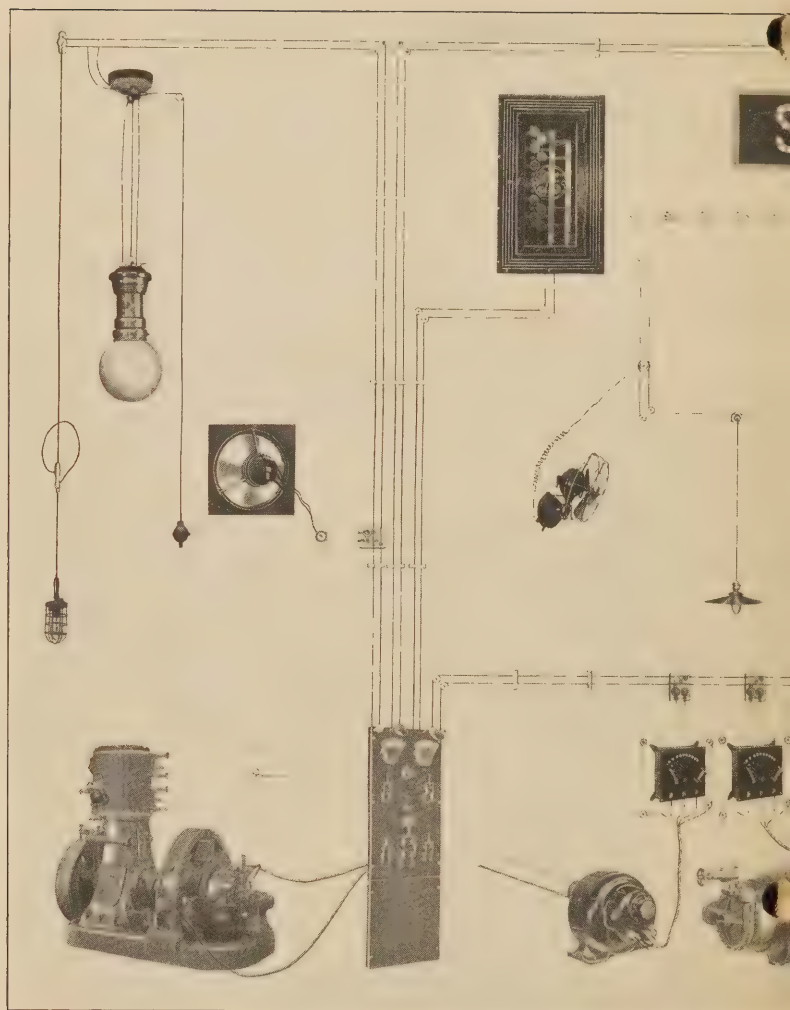
ALTERNATING CURRENT APPARATUS



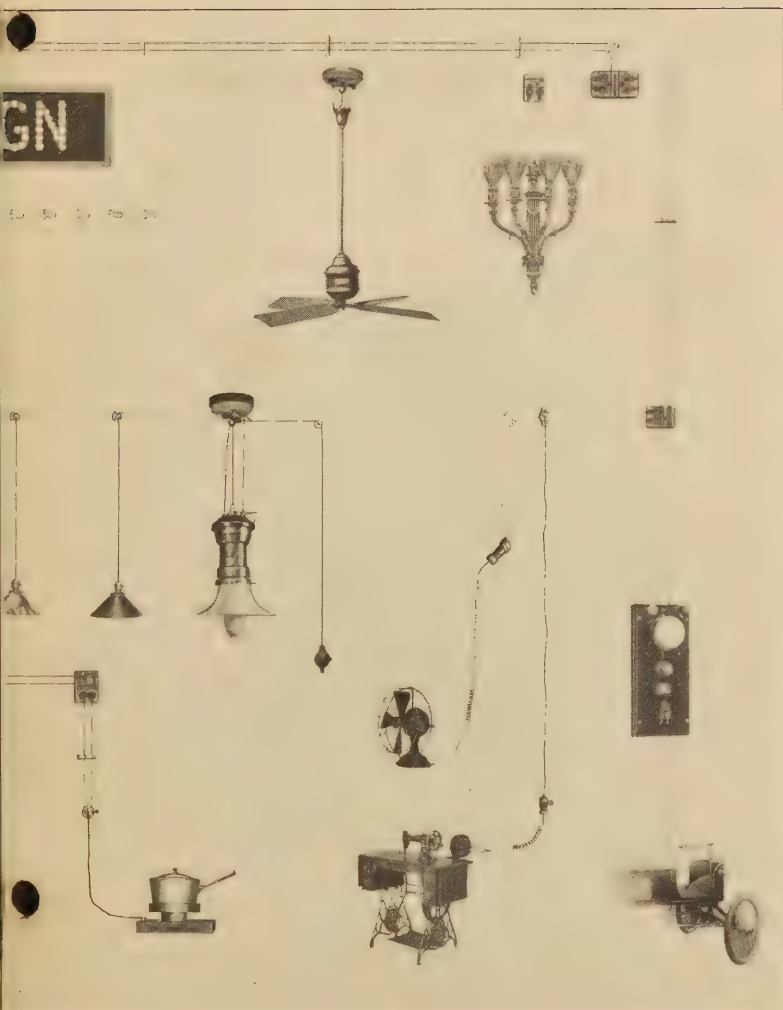
75 H.P. INDUCTION MOTORS OPERATING
THE TWINE MILL OF THE DEER-
ING HARVESTER COMPANY

IN very large establishments where an entire factory is to be electrically operated, there are some reasons why alternating current apparatus should be installed instead of the direct current generators previously referred to. In such cases either belt driven or direct driven generators are furnished. These are manufactured in different types according to the particular purpose for which they are required,





SUGGESTED USES OF ELECTRICITY



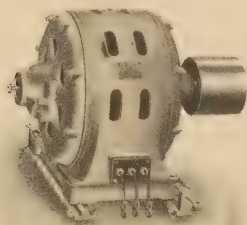
CITY IN ISOLATED PLANTS.

GENERAL ELECTRIC COMPANY

ALTERNATING CURRENT MOTORS

THE use of alternating current generators makes essential the employment of induction or other alternating current motors; these are made by this Company in various sizes for all kinds of work.

The General Electric Company has equipped many of the largest manufacturing establishments in the country with this class of apparatus; typical among these are the Great Northern Paper Co., Norcross and Madison, Me., the Amoskeag Manufacturing Co., Manchester, N. H., the Pelzer Manufacturing Co., Pelzer, S. C.



A STANDARD THREE-PHASE
INDUCTION MOTOR

TRANSFORMERS

AN alternating current system necessitates the use of transformers. These the General Electric Company manufactures in various types, each suited to certain conditions of service. For ordinary isolated plant work, the Type H oil cooled transformers are most commonly used.

Full information on any of the parts of an alternating current system will be gladly sent upon request.



A TYPE H
OIL TRANSFORMER



SWITCHBOARDS

NO plant is complete without a switchboard fitted with proper instruments and devices for controlling the generator and circuits.



AN ISOLATED PLANT
SWITCHBOARD PANEL

Wherever electric generators are installed, more or less controlling apparatus is necessary, which is most suitably grouped as a switchboard. The General Electric Company manu-

factures for this service a line of standard switchboard panels intended to meet every requirement of small installations.

These are known as isolated plant switch-

boards and will be found especially convenient, as various classes of panels can be assembled, making the switchboard suitable for the exact requirements of any particular plant. These switchboards are made of black enameled slate, and the switches and other devices are of approved design and substantially constructed. Such



AN ILLUMINATED
DIAL AMMETER

GENERAL ELECTRIC COMPANY

instruments are selected from the large variety manufactured by this Company as are most suitable for the purpose. They excel in accuracy and durability.

These switchboards form an attractive addition to any plant, but there are some small installations for which they would be unnecessarily large. For these, the General Electric Company's "small plant switchboards" are recommended as being most suitable. They present a handsome appearance, the devices being mounted on black

A SMALL PLANT
SWITCHBOARD

enameled slate. These are shipped from the factory complete, ready for connecting to the circuits, and this will be found a great convenience where the installing is done by those inexperienced in electrical construction.



CABINET PANELS

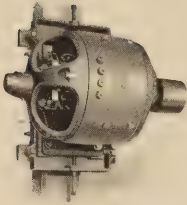
IN connection with the equipment of an isolated plant, a most convenient device is found in the standard cabinet panels furnished by this Company. These are intended for use at the various centers of distribution about a large building, and beside being extremely convenient they present a very attractive appearance. The panels are of black enameled slate, and all the metal parts are polished copper. The fuses used on these panels are of the convenient Edison plug type, which are commended for their safety and the convenience with which they may be replaced without the use of tools.



A SIX CIRCUIT SINGLE BRANCH PANEL
IN CABINET

DIRECT CURRENT MOTORS

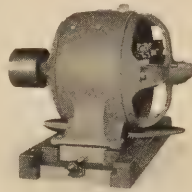
THE use of electricity in a manufacturing establishment implies the desire for operating electric motors, and



A CE MOTOR
FOR WALL INSTALLATION

of these the General Electric Company makes a very complete line for all classes of service. For the largest work, motors of a design similar to the Form H generators referred to on previous pages are used. Where not more than 20 H.P. is required, the Type CE motors are preferable.

These motors are the result of many years of experience in this class of work, and embody all of the features recognized as essential for successful operation. They can be furnished for use on the floor, or for mounting on the wall or ceiling. They are fitted with sliding base frames and drip pans, and altogether are extremely satisfactory for general power purposes. When desired, they may be fitted with improved belt tighteners, thus permitting the motor to be operated close to the machine driven.



A CE MOTOR
WITH SLIDING BASE
FRAME

GENERAL ELECTRIC COMPANY



CA 2-H.P.-1100
MOTOR

For 2 H.P. and less, the Type CA motor has been developed. It is of the bipolar type, and is enclosed, with openings over the brush-holders, which if desired can be

provided with removable covers, thus making the motor suitable for operation in places where open type motors would be impractical. These motors can be fitted with belt tighteners. Both the CE and the CA Types of motors are largely used for direct driving machines by means of gears, in which case, of course, special construction is necessary.

Small motors specially designed are also furnished for driving sewing machines and automatic musical instruments.



A MOTOR-DRIVEN SEWING MACHINE
FOR DOMESTIC USE

INCANDESCENT LAMPS

THE General Electric Company is the largest manufacturer of incandescent lamps in the world. It has for many years manufactured incandescent lamps for every purpose, and its present product represents an evolution, the lamps being universally regarded as most suitable for each class of work for which they are supplied. Standard lamps for ordinary lighting purposes can, of course, be supplied in any desired voltage, 16 C. P. being most in use. If, however, lamps are desired for any particular purpose such as signs or decoration, a lamp especially built for these purposes will be supplied. Any manufacturing establishment would be greatly benefitted by using permanent electric signs and special lighting on certain occasions, all of this being easily and economically accomplished by the use of Edison lamps made for the particular purpose required.



A STANDARD INCANDESCENT LAMP



LIGHTING SUPPLIES

THE lamp sockets and receptacles required in isolated plants may all be purchased from the General Electric Company, which manufactures a line of these devices, covering every conceivable requirement. This includes sockets for drop lights, weatherproof sockets for damp places, porcelain sockets for dye-houses and places where acid fumes are present, and porcelain lamp receptacles for both concealed wiring and cleat wiring. Portable incandescent lamp holders are convenient and can be supplied by this Company. Socket bushings, cord adjusters, attaching plugs, shade holders and all of the various small supplies required with incandescent lighting can also be furnished.

When installing an isolated plant, a great deal of insulated wire of various sizes is, of course, necessary. This the General Electric Company manufactures in its own shops in Schenectady. Besides the enormous quantities required in the manufacturing of its own apparatus, it regularly sells a large amount of all sizes of insulated wire, cable and flexible lamp cord for all kinds of construction. The Company's shops for this work are as fine as any in the

GENERAL ELECTRIC COMPANY

country. It is evident, therefore, that persons contemplating the installation of an isolated plant will do well to secure also their wire and cable from the company manufacturing their generators and other electrical apparatus. The General Electric Company has also its own porcelain works, and regularly ships porcelain insulators of all kinds. For ordinary construction, certain insulators of peculiar design are manufactured exclusively by this Company.

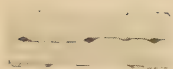
The General Electric Company manufactures all the devices needed for a complete installation. A few of the most prominent are given in the following list :



ARC LAMP HANGER BOARDS
AND
ARC LAMPS



GENERAL ELECTRIC COMPANY



PORCELAIN
CLEATS



PORCELAIN
KNOBS



LAMP
SOCKETS
FOR
DROP
LIGHTS



PORCELAIN
SOCKETS
FOR DYE
WORKS, Etc.



WEATHER-
PROOF
SOCKETS



PORCELAIN
RECEP-
TACLES FOR
CLEAT
WIRING
AND
CONCEALED
WIRING



ATTACHING
PLUGS



ROSETTES

GENERAL ELECTRIC COMPANY

SOCKET
BUSHINGS



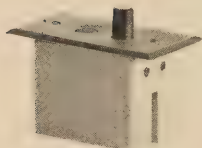
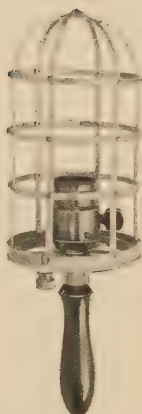
CORD
ADJUST-
ERS



SHADE
HOLDERS



LAMP
GUARDS
AND
PORTABLE
LAMP
HOLDERS



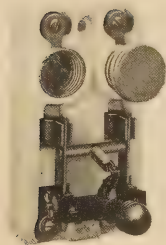
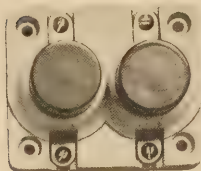
FLUSH
POCKET
SWITCHES

GENERAL ELECTRIC COMPANY

PENDANT
PUSH
BUTTON
SWITCHES



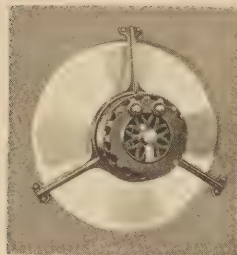
SNAP
SWITCHES



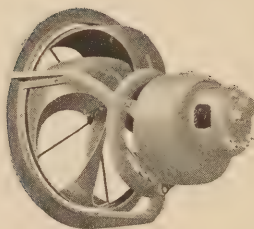
CUT-OUTS



GENERAL ELECTRIC COMPANY



ELECTRIC
FANS
AND
ELECTRIC
EXHAUSTERS



USEFUL INFORMATION

Incandescent lamps are made in three efficiencies known as 3.1; 3.5 and 4 watts per candle.

Thus a 16 candle-power 3.1 watt lamp consumes 49.6 watts or practically 50 watts. A 16 C. P. 3.5 watt lamp consumes 56 watts. A 16 C. P. 4 watt lamp consumes 64 watts.

For ordinary isolated plants we recommend the 3.5 watt lamp.

A kilowatt equals 1000 watts, so a 25 Kw. dynamo would have a capacity of $\frac{25000}{56} = 446$ —16 C. P. lamps without allowing for any losses in the lines. If 3.1 watt lamps are used a greater number can be connected.

Example :

Find dynamo capacity required to supply 325—16 C. P. 3.5 watt lamps allowing 10% losses

$325 \times 16 \times 3.5 = 18200$ watts = 90% total watts

$\frac{18200}{.90} = 20220$ watts = 20.22 Kw.

In mills of various kinds it is customary to allow 5% loss in feeders from the dynamo to the center of electrical distribution, and 2% loss in the mains from which the lamps are served.

GENERAL ELECTRIC COMPANY

The Ampere is the unit of current.

The Volt is the unit of pressure.

The Watt is the unit of electrical energy and is the product of one ampere and one volt.

One Electrical Horse-power is equal to 746 watts.

One Kilowatt is equal to 1000 watts.

Examples :

Find watts generated by a dynamo having a capacity of 50 amperes at 125 volts

$$125 \times 50 = 6250 \text{ watts} = 6.25 \text{ Kw.}$$

Find current required for 50-16 C.P. 3.5 watt lamps at 110 volts

$$50 \times 16 \times 3.5 = \frac{2800 \text{ watts}}{110 \text{ volts}} = 25.45 \text{ amperes}$$

Find electrical horse-power required by 100-16 C. P. 50 watt lamps

$$\frac{100 \times 50}{746} = 6.7 \text{ electrical horse-power.}$$



SIMPLE RULES FOR FINDING CORRECT SIZE OF WIRE FOR TWO-WIRE SER- VICE

The square of the diameter of a given wire expressed in mils (1 mil = .001") gives the circular mils.

M=Circular Mils.

C=Current in Amperes.

D=Average Distance Current is transmitted one way.

P=Per Cent. Loss allowed.

21=Constant.

To ascertain size of wire

$$M = \frac{C \times D \times 21}{P}$$

Example:

Find size of wire necessary to transmit current for 200-16 C. P. 3.5 watt lamps at 120 volts dynamo pressure a distance of 600 feet, allowing 5% loss

5% of 120 volts=6 volts which will give 114 volts at center of distribution. Allowing 2 volts more for losses in the mains and services we would use 112 volt incandescent lamps

$$\text{So } \frac{200 \times 16 \times 3.5}{112} = 100 \text{ amperes}$$

$$M = \frac{100 \times 600 \times 21}{6} = 210000.$$

By referring to the table on next page it will be found a #0000 wire is the correct size.

GENERAL ELECTRIC COMPANY

COPPER WIRE DATA
INCLUDING WEIGHT PER 1000 FEET
OF FIRE- AND WEATHERPROOF

Size B. & S. Gauge.	Diam. in Mils.	Circular Mils.	Weight per 1000 Feet F. & W. P.
0000	460.000	211600.0	790
000	409.640	167805.0	650
00	364.800	133079.0	537
0	324.950	105592.5	452
1	289.300	83694.5	369
2	257.630	66373.2	315
4	204.310	41742.6	180
6	162.020	26250.5	129
8	128.490	16509.7	84
10	101.890	10381.6	60
12	80.808	6529.94	39
14	64.084	5178.39	32
16	50.820	2582.67	25
18	40.303	1624.33	19



GENERAL ELECTRIC COMPANY

Sales Offices :

BOSTON, MASS., 200 Summer Street.
NEW YORK, N. Y., 44 Broad Street.
Syracuse, N. Y., Sedgwick, Andrews & Kennedy Bldg.
Buffalo, N. Y., Ellicott Square Building.
PHILADELPHIA, PA., 218-226 South Eleventh Street.
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Dallas, Texas, Scollard Building.
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